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Reliability-based bi-directional evolutionary topology optimization of thermoelastic structures

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ABSTRACT

The scope of this study is to incorporate the reliability-based design into thermoelastic structural topology optimization. Therefore, geometrically nonlinear reliability-based topology optimization (RBTO) of thermoelastic structures is examined. The significance of considering volume fraction parameter as a random variable in case of RBTO that the resulted topologies have different material layouts compared to those topologies which are resulted by deterministic design. The influence of changing the constraint of defined volume of design domain in deterministic problems is studied. Furthermore, the effect of changing reliability indices in probabilistic problems is studied as well. The reliability index is introduced to the optimization problem as a constraint which is related to the volume fraction, and it is determined through Monte-Carlo simulation technique for probabilistic designs. Bi-directional evolutionary structural optimization (BESO) method is adopted to study geometrically nonlinear thermoelastic models. The suggested work's effectiveness is illustrated via benchmark problem. Finally, a 2D L-shape beam model is considered also in this study for probabilistic linear and geometrically nonlinear thermoelastic topology optimizations.

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